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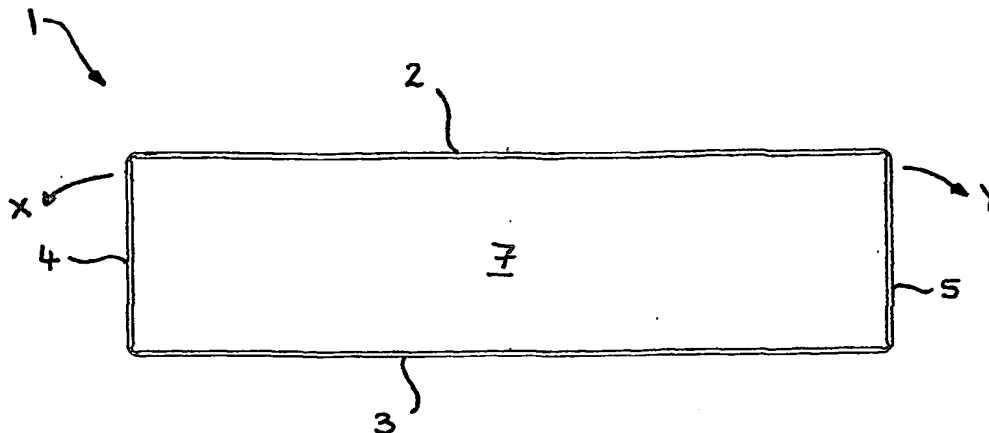
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For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: VENTILATION DUCT



(57) Abstract: A seamless ventilation duct (1) is disclosed. The duct (1) includes integrally formed hinge means (6) that enables the duct (1) to be collapsed for transportation and/or storage prior to use.

## Ventilation Duct

### Description

The present invention relates to a ventilation duct or tube primarily used in  
5 buildings to convey hot or cold air for heating and cooling purposes respectively,  
and in other circumstances where a circulation of air or fluids is required.

Conventional ducting of tubing is usually assembled prior to delivery to the  
installation site so that it can be installed quickly without any further assembly.

10 However, this means that the ducting is cumbersome and bulky and so is difficult to  
transport easily. This results in an increase in costs.

Ventilation ducts are known which are delivered to the installation site as individual  
panels which are then assembled prior to installation. However, assembly is time  
15 consuming and often requires welding equipment or the ducting includes other  
components to enable the panels to be connected together. Again, the need for  
additional components increases manufacturing costs.

It is an object of the present invention to overcome or substantially alleviate the  
20 disadvantages with conventional ducting and provide a ventilation duct that has the  
desirable aspects of being easily manufactured, stored, transported and erected for  
installation.

According to the invention, there is provided a seamless ventilation duct including  
25 integrally formed hinge means to enable the duct to be collapsed for transportation  
and/or storage.

In a preferred embodiment, the duct comprises a plurality of elongate panels, each  
panel being joined to an adjacent panel by the integrally formed hinge means to  
30 enable relative movement between said panels.

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Preferably, the hinge means comprises an elongate channel in the duct between each panel so that the duct folds in the region of the channel to enable relative movement between the panels.

- 5 Each panel is preferably disposed substantially at right angles to two adjacent panels when the duct is erected.

In a preferred embodiment, each panel is rigid or semi-rigid and forms one side-wall of the duct.

10

When the duct is collapsed, each side-wall conveniently lies substantially in contact with another side-wall.

- 15 The side-walls preferably define a parallelogram in cross-section. However, it is envisaged that their may be more than four side-walls in which case the side-walls together define a multi-sided profile in cross-section.

- 20 The duct is advantageously made from plastics material such as polypropylene or PVC. However, it may also be made from any thermoplastic or thermoplastic elastomer with appropriate physical properties to produce an effective hinge mechanism. The duct is preferably extruded. However, it is envisaged that other methods of manufacture such as injection moulding or blow moulding could be employed.

- 25 The present invention also provides a method of manufacturing a seamless extruded ventilation duct including integrally formed hinge means comprising the steps of extruding or moulding the duct, allowing the duct to cool and folding the duct about the hinge means to collapse it for transportation or storage.

- 30 The duct may be extruded or moulded in an erect or partially erect condition. However, it may alternatively be extruded in a flat condition and subsequently erected for installation.

- 3 -

An embodiment of the invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:

FIGURE 1 illustrates an end view or cross-sectional view of a ventilation duct shown in a fully erect state, according to the invention;

5 FIGURE 2 illustrates an enlarged partial view of part of the ventilation duct shown in Figure 1;

FIGURE 3 illustrates an end view or cross-sectional view of the ventilation duct shown in Figure 1, but in a fully collapsed state, and

10 FIGURE 4 illustrates an enlarged partial view of part of the ventilation duct shown in Figure 3.

Referring now to the drawings, there is shown in Figure 1 an end view or cross-sectional view of a rectangular ventilation duct or tube 1 according to the invention comprising parallel first and second major walls 2,3 spaced from each other by first and second minor walls 4,5, the walls 2,3,4,5 together forming an hollow elongate duct space 7. The duct 1 is seamless and is integrally formed by extrusion in one tubular piece. The longitudinal edge of each wall is connected to an adjacent wall by hinge means 6 formed from elongate channels cut into the duct 1. As can be seen more clearly from Figure 2, each channel 6 comprises a region in the duct 1 having a reduced wall thickness which makes the duct more flexible in that region. The flat planar surfaces of the walls 2,3,4,5 themselves have a greater thickness and so are rigid or semi-rigid so do not flex so readily. Although the illustrated embodiment shows a duct 1 having a generally rectangular cross-section, it may also be square in cross-section in which case each wall 2,3,4,5 has the same width.

25 The duct 1 formed by the walls 2,3,4,5 and the hinge means 6 is extruded as a tube in one-piece and, preferably, in the form in which it is shown in Figure 1 namely, in its fully erect state and in which the major walls 2,3 and minor walls 4,5 are at right angles to each other. However, it could also be extruded in a partially collapsed state.

30

Referring to Figure 3, the duct 1 is illustrated in a completely collapsed or folded-flat condition in which the major wall 2 and minor wall 4 overlap major wall 3 and

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minor wall 5. Collapse of the duct 1 is achieved by applying a shear force to the duct in the direction of arrow "X" or "Y" in Figure 1 sufficient to cause the duct to fold or crease about the hinges 6. The duct 1 shown in Figure 3 has been collapsed by applying a force in the direction of arrow "Y".

5

Figure 4 illustrates an enlarged view of the region of the hinge 6 between major wall 2 and minor wall 4 and between minor wall 4 and major wall 3. As can be seen, the angle between these two walls 3,4 has been reduced substantially to zero so that the faces of these walls 3,4 now lie in contact. The channel forming the hinge 6 now  
10 assumes a generally hemispherical opening when the duct 1 is in the folded state.

As can be seen most clearly in Figure 2, the channel has a bottom wall 8 and two side walls 9. The bottom wall 8 may define an arcuate surface and the side walls may extend from the bottom wall 8 at an angle of 90 degrees or some other angle. A  
15 smooth radius may connect the bottom wall 8 to each side wall 9 and each side wall 9 to the face of the wall in which the channel is formed.

It will be appreciated that when the duct 1 has been extruded, it can be folded from its erect state shown in Figure 1 into its folded state shown in Figure 3 due to the  
20 flexibility of the duct 1 in the region of the channels to substantially reduce its size and substantially simplify storage and transportation.

It will be appreciated that the duct 1 will usually only need to be folded flat once i.e. immediately following manufacture and erected once for installation. Once  
25 installation is complete, there is generally no requirement to ever fold the duct again. Therefore, the material of the duct 1 and in particular the thin-walled section of the duct 1 in the region of the channel only needs to be capable of being flexed two, or possibly a few times, without breaking in order for the duct 1 to be collapsed and erected for installation. Preferably, the material will maintain a degree  
30 of stiffness despite being flexed so that the duct 1 can be released in its erect state without collapsing under its own weight.

- 5 -

In a preferred embodiment, the duct 1 is made from plastics material which can be extruded easily. Preferred materials are polypropylene or PVC or any other thermoplastic or thermoplastic elastomer with appropriate physical properties to produce an effective hinge mechanism.

5

Although in one embodiment, the hinge means 6 and the walls 2,3,4,5 are all extruded from the same material, it is also envisaged that the hinge means 6 could be formed from a dissimilar material to the walls 2,3,4,5. For the avoidance of doubt, the walls 2,3,4,5 and the hinge means 6 are still extruded together and so the duct remains seamless even when the hinge means 6 are formed from a different material. This can be achieved using a dual hardness extrusion process.

10

It can be seen that the present invention provides a ventilation duct that can be manufactured, collapsed and erected easily. As the duct is entirely formed from one component or piece, there are no additional components and no tools required to assemble it. Therefore, the duct is cheaper to make and easier to assemble.

15

Furthermore, as the duct is seamless, it is not necessary to join two ends or walls together when the duct is erected. This is an important aspect of the duct of the invention as no joining technique such as welding or riveting needs to be employed either after manufacture or at installation site.

20

This description relates to a preferred embodiment only and all modifications falling within the scope of the appended claims are also considered to form part of the invention.

## Claims

1. A seamless ventilation duct including integrally formed hinge means to enable the duct to be collapsed for transportation and/or storage.
- 5 2. A seamless ventilation duct according to claim 1, comprising a plurality of elongate panels, each panel being joined to an adjacent panel by the integrally formed hinge means to enable relative movement between said panels.
- 10 3. A seamless ventilation duct according to claim 2, wherein said hinge means comprises an elongate channel in the duct between each panel so that the duct folds in the region of the channel to enable relative movement between the panels.
- 15 4. A seamless ventilation duct according to claim 2 or 3, wherein each panel is disposed substantially at right angles to two adjacent panels when the duct is erected.
5. A seamless ventilation duct according to claim 4, wherein each panel is rigid or semi-rigid and forms one side-wall of the duct.
- 20 6. A seamless ventilation duct according to claim 5, wherein each side wall lies substantially in contact with another side-wall when the duct is collapsed.
7. A seamless ventilation duct according to claim 5 or 6, wherein the side walls  
25 define a parallelogram or other multi-sided profile in cross-section.
8. A seamless ventilation duct according to any preceding claim, wherein the hinge means are formed from a dissimilar material to the side walls.
- 30 9. A seamless ventilation duct according to any preceding claim, wherein the duct is made from plastics material.

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10. A seamless ventilation duct according to claim 9, wherein the duct is made from thermoplastic or thermoplastic elastomer.
11. A seamless ventilation duct according to claim 9, wherein the duct is made  
5 from polypropylene or PVC.
12. A seamless ventilation duct according to any preceding claim formed by extrusion.
- 10 13. A seamless ventilation duct substantially as hereinbefore described with reference to the accompanying drawings.
14. A method of manufacturing a seamless ventilation duct including integrally formed hinge means comprising the steps of extruding or moulding the duct,  
15 allowing the duct to cool and folding the duct about the hinge means to collapse it for transportation or storage or erect it for installation.
15. A method according to claim 13, wherein the duct is extruded in a collapsed condition.  
20
16. A method according to claim 14, wherein the duct is extruded in a partially erect or erect condition.
17. A method of manufacturing a seamless ventilation duct, wherein the hinge  
25 means are extruded from a different material to the rest of the duct.
18. A method of manufacturing a seamless ventilation duct substantially as hereinbefore described.



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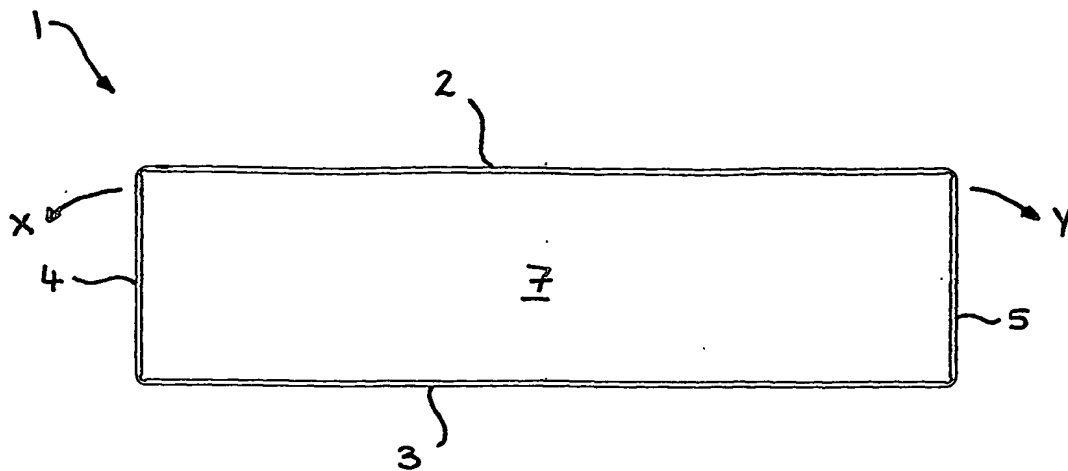


FIGURE 1

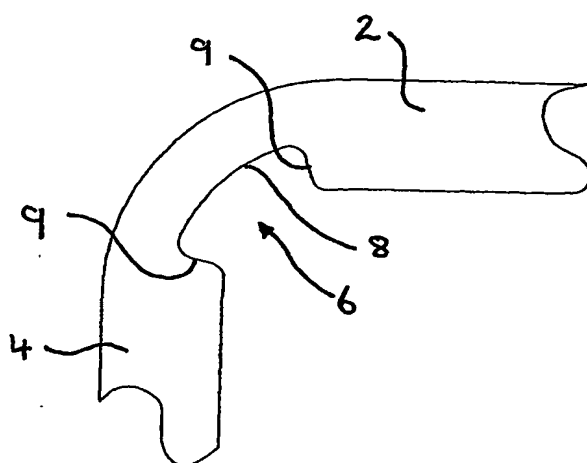


FIGURE 2

2/2

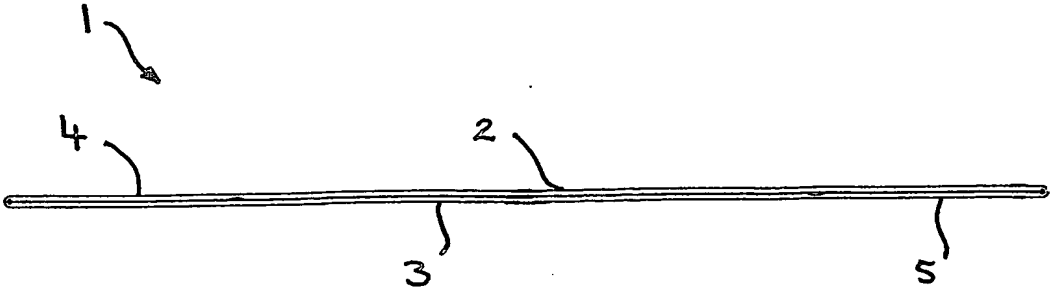


FIGURE 3

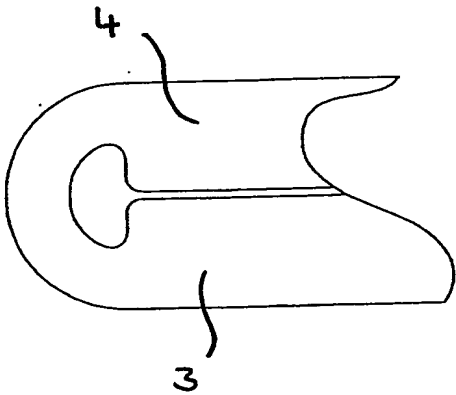


FIGURE 4

## INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 F24F13/02 F16L9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F24F F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 285 818 A (HUMMERT III AUGUST H) 15 February 1994 (1994-02-15)	1
Y	the whole document	2-7, 9-12, 14-16
Y	GB 1 241 413 A (ATOMIC POWER CONSTRUCTIONS LIMITED) 4 August 1971 (1971-08-04) claims 1,3; figures 9,10	2-7, 9-11
Y	DATABASE EPODOC EUROPEAN PATENT OFFICE, THE HAGUE, NL; XP002289554 abstract	12, 14-16
Y	-& GR 1 002 959 B (DAIOS ASTERIOS) 1 September 1998 (1998-09-01) abstract; figures	12, 14-16
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## ° Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search

10 August 2004

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 140 (M-305), 29 June 1984 (1984-06-29) -& JP 59 038542 A (BABCOCK HITACHI KK), 2 March 1984 (1984-03-02) abstract	1
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 10, 31 October 1996 (1996-10-31) -& JP 08 159378 A (SEKISUI CHEM CO LTD), 21 June 1996 (1996-06-21) abstract	12,15,16
A	US 2 378 272 A (WHITAKER LAURENCE E) 12 June 1945 (1945-06-12) the whole document	1

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB2004/001592

### Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 13, 18  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 6.2 PCT
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

PCT/GB2004/001592

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5285818	A	15-02-1994	US CA	5137057 A 2017420 A1	11-08-1992 26-11-1990
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